TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

TARDEC Robotics

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
12 JAN 2010	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
TARDEC Robotics	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
James L. Overholt	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
US Army RDECOM-TARDEC 6501 E 11 Mile Rd Warren, MI 48397-5000, USA	**20509RC**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	TACOM/TARDEC
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)
	20905RC

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**SAR**	**15**	

TARDEC Robotics

Mission

Integrate, Explore, and Develop Robotics, Network and Control Components with a Focus on Customer Driven Requirements to Provide Full System Solutions to the War Fighter

Technology Components

Integration

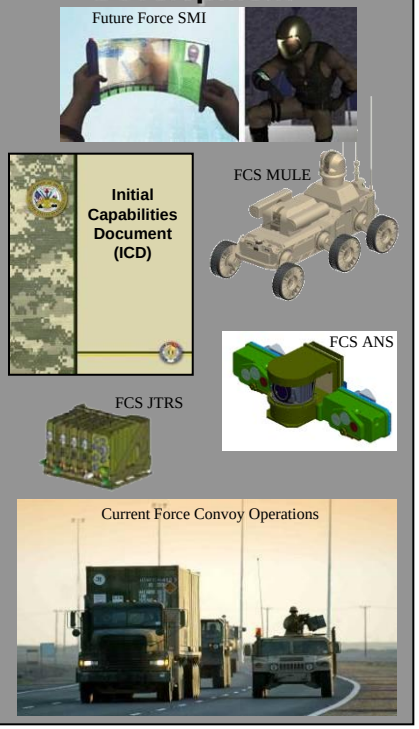
Demonstrators

SME Defined Scenarios

Military Relevant Test & Experimentation

Tech Transfer

Transition and Requirements Development



Integration Technology Development Lessons Learned to Enable Early Technology Insertion

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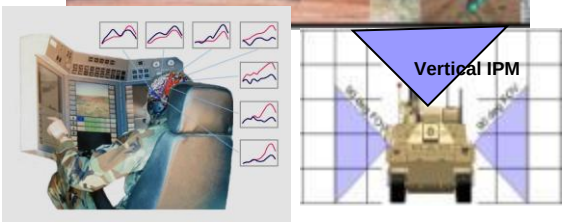
TARDEC Robotics/Interface Initiatives

Leverage world-class expertise to get technologies to Warfighters faster

Curriculum Development & Education Outreach

Advanced System Demonstrators and Experimentation



ARMY

Advanced Interfaces and 360° Situational Awareness

Robotic ONS Development

Partnership with III Corp and TRADOC-ARCIC

Focused on developing robotic requirements for Convoy Operations, Route Clearance, Persistent Stare, and Robotic Wingman

Robotics Innovation Workshop

TARDEC and TRADOC - ARCIC partnered to scope robotics technology areas for Army's future

Identified tasks in in Engineering, Security, Medical, Maintenance and Logistics Robotics

Automotive-Robotics Cluster Initiative Partnership (ARCIP)

Partnership with the Small Business Administration (SBA)

Identified partnerships between Michigan automotive-based corporations to grow the military robotics cluster in SE Michigan

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Robotics Rodeo

The Robotics Rodeo had three stated goals: **educate** key decision makers and **align** the robotics industry; **educate** Soldiers and developers; and **observe** the current state of technologies to encourage the development of robotic systems to support operational needs.

Tangible Benefits

- Momentum
- New business model
- Searchable database
- Referrals to PMs
- Feedback to vendors

Outcomes

- Large Autonomous Vehicles
  - + Supervised autonomy is close
  - + Appliqué kit
  - - Autonomy not as good as human
- General Robotics / RSTA
  - + Clever solutions to technical capability areas
  - + Components mature
  - - Systems integration needed
  - - Low TRLs

Next

- TRADOC defined capability gaps for next Rodeo
- Assist in further development of ONS as well as procurement strategies
  - Conduct user assessment as needed
- Next Rodeo targeted for Sep / Oct 10 location TBD

US/Australia Robotics Challenge

MAGIC 2010 DOWN UNDER

Multi Autonomous Ground-robotic International Challenge

US ARMY RDECOM

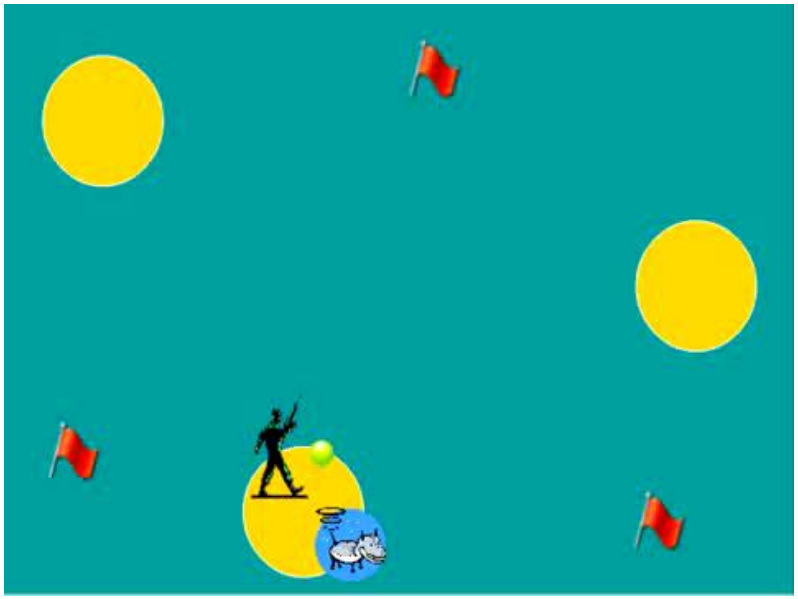
Australian Government
Department of Defence
Defence Science and Technology Organisation

- MAGIC is a Joint US/Australia Robotics Challenge
  - November 2010, in conjunction with Australian MOD Land Warfare Conference
- Emphasis on autonomy, inter-operability, user-to-robot ratio, data mapping, neutralizing mobile and static objects of interest, and heterogeneous robot teaming
- Down select to 5 teams competing
  - Oct 09: 32 proposals were down selected to 12
  - Jun 10: final 5 teams selected based on site visit and demonstration
- Prizes 1st-$750K, 1st, 2nd-$250K & 3rd-$100K
- TARDEC is the U.S. Lead

Collaborative Autonomous Navigation with Interactive Networked Engagement (CANINE)

CANINE intent on researching and developing advanced robotic collaborative behaviors through the teaming of industry and academia in a multi-year, multi-award, contract through the Robotics Technology Consortium where the advancement to the second year is contingent on performance at a completive down-select.

The desired behaviors are akin to those possessed by the military working dogs of years past. The focus is on the “Fetch” and “Surveillance” behaviors of these animals.



Year 1 - 6 Awards, $250k per recipient

Year 2 - 3 Awards, $500k per recipient

Joint Center for Robotics

- S&T Support to the RS-JPO
- Develops and Fosters external Relationships
- Matures technology for Insertion into ATO programs
- Robotics Outreach
- RS JPO Collaboration Cell Lead
- Support to IGS Capability Cells
- Robotics Academic Programs (Including Curriculum Development)

Government Partnerships	Industry Partnerships	Academia Partnerships	Community Outreach
TRADOC	Ford, GM, Toyota, ABB, Raytheon, John Deere, Quantum Signal, LLC, IRobot, Google, Think-A-Move, Foster-Miller, JADI, Lockheed Martin, Soar Technology, Delphi, Oshkosh, Polaris, General Dynamics	Michigan State, Wayne State University, MIT, U of D, Carnegie Mellon, Michigan, Oakland University, Virginia Tech, Michigan Tech, University of Detroit Mercy, Lawrence Tech University	TARDEC Robotics Quarterlies; Robotics, Engineering and Technology Days

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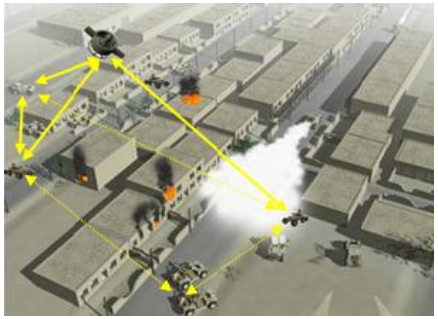
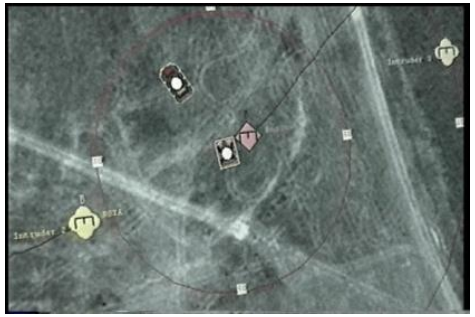
Near Autonomous Unmanned Systems (NAUS) ATO

Purpose:
Increase the level of autonomy of Unmanned Ground Vehicles (UGVs) toward operational consideration

Products:
- **Near-autonomous UGV operations in dynamic environments**
- **Near-autonomous dynamic UGV/MGV Tactical Formations**
- **UGV System Self Security through pedestrian Intent inference**





Robotics Collaboration (RC) ATO

Purpose: Develop the tools, techniques, & autonomy to maximize mounted and dismounted control of ground and air unmanned systems and optimize Soldier-robot and robot-robot ground and air teams

Scalable Interface:

– Increased scalability, portability and tailorability of Soldier Machine Interface—reduces training burden

– Control multiple unmanned system– one device can support unique robots from different vendors

Driving Aids:

– Enables Soldiers to take actions of a semi-auto vehicle while staying in obstacle avoidance

– Increased mission OPTEMPO, reduced intervention times

– Provides Situational Awareness of unmanned system

– Increased insight in unmanned system planning activities

Improved Mobility and Operational Performance through Autonomous Technologies (IMOPAT) ATO

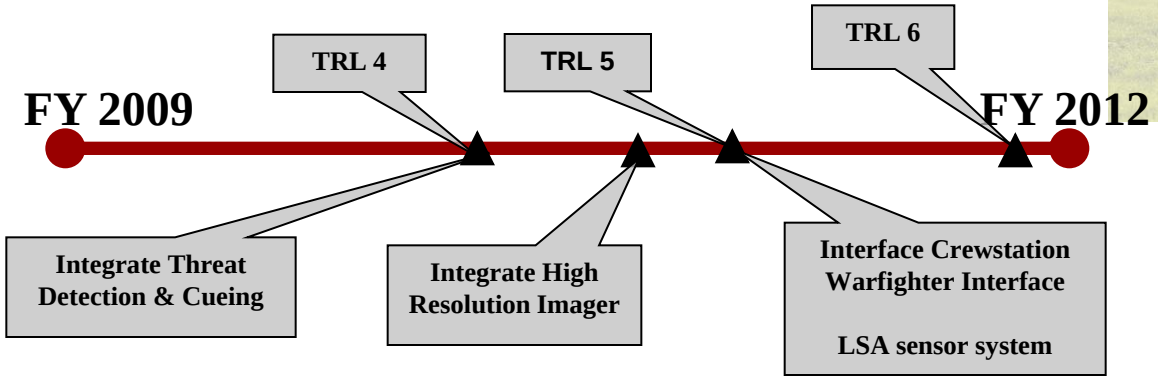
360/90 Day/Night
Near-field Sensor Coverage

Soldier Monitoring
& State Classification

Advanced
Crew Stations

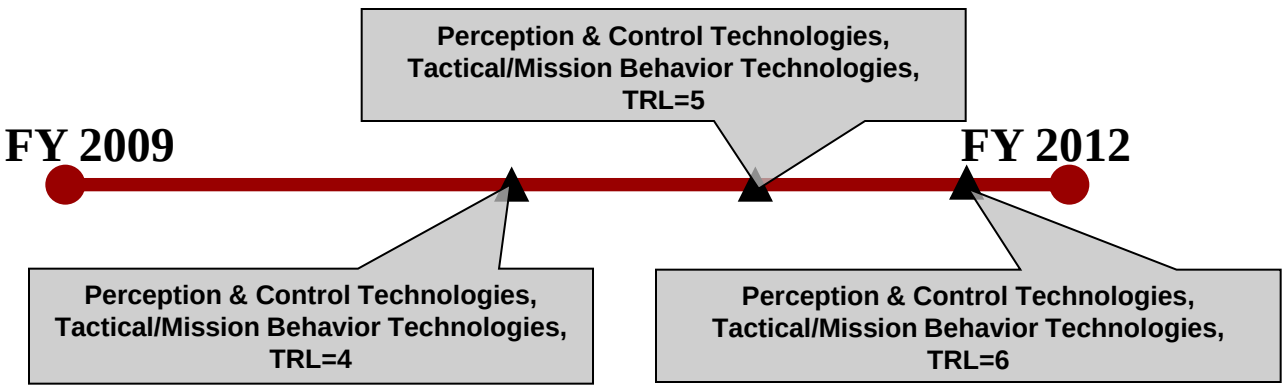
Enhance, Integrate and Demonstrate 360/90 LSA/Assisted Mobility/Human Dimension to Maximize Indirect Vision 360/90 LSA and Mobility Capabilities (Secure Mobility)

- **Focus on closed-hatch operations, indirect vision**
- **360/90 degree local area awareness**
- **Improved mobility via non-LADAR and LADAR based solutions**
- **Improved assessment and integration of operator performance in real-time**
- **Increase situational awareness for all crew members**



Safe Operations of Unmanned systems for Reconnaissance in Complex Environments (SOURCE) ATO

- Safer operations of UGVs in proximity to pedestrians and vehicles
- Increase in vehicle autonomy to enable less supervisory burden
- Increased UGV situational awareness
- Robust Soldier/robot and robot/robot teaming behaviors
- Robust UGV performance in all environments/conditions
- Simulation of platform, payload and algorithms in relevant operational environment



Convoy Active Safety Technologies (CAST)

Program Goals:

– Provide low cost ($10-20K) convoy automation (Leader/Follower) capability for current force Army vehicles

– Support Warfighter requirement for convoy automation and active safety

– Provide Robotics capability in CS/CSS community

– Leverage RF, RDECOM and other FCS Technologies

Enhanced Soldier Protection

- Increased Situational Awareness
- Reduced Collisions
- Reduced crew driving tasks
- Reduced fatigue
- Increased Driver Cognition

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Safe Operations (SafeOps)

Program objectives:

- **Increase Soldier Directly address risks associated with employing UGVs in dynamic environments**

- **Identify risk areas of operating UGVs around moving traffic, pedestrians & dismounted forces**

- **Integrating FCS representative technologies**

- **Dismounted forces safety**

- **Maintain lane among civilian traffic**

- **Develop the tools, techniques & autonomy to maximize mounted & dismounted control of ground and air unmanned systems and optimize Soldier-robot and robot-robot ground & air teams**

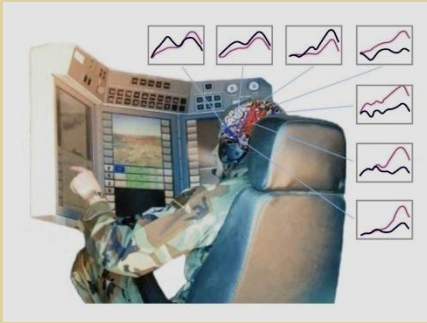
Crewstation Advancements

PAST
- Workload reduction
- Embedded crewstation

PRESENT
- Robotic control (mounted, dismounted)
- Driving aids (Soldier assist)
- Scalable, portable Interface

Dismounted Controller

FUTURE
- Soldier monitoring and task assist
- Intelligent agents
- 360 degree situational awareness



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Questions